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NASA TECH BRIEF

Hermetically Sealed Pump

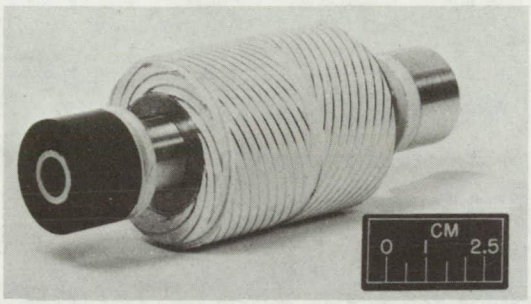

Fig. 1a. The Pumps Grooved Rotor

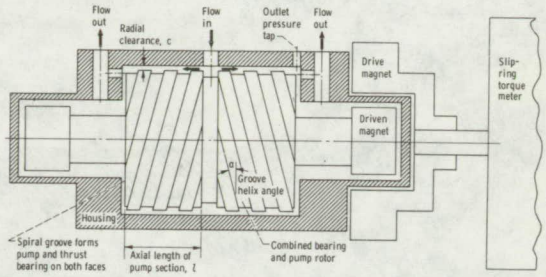

Fig. 1b. Hermetically Sealed Pump

A mechanically simple, hermetically-sealed pump which utilizes the pumped fluid for lubrication has been conceived and the concept tested.

Helically-grooved seals, because of their "no rubbing contact" feature, have been used successfully for sealing unusual or highly corrosive liquids, or liquids with poor lubricating qualities. (See NASA Tech Briefs 68-10134, "Shallow Grooves in Journal Improve Air Bearing Performance," and 68-10270, "Spiral-Grooved Shaft Seals Substantially Reduce Leakage and Wear.") The helically-grooved seals produce their sealing action through fluid pressure generated by the helical groove geometry. The same fluid pressure generation technique can also be applied to bearing and pumping functions. Thus by combining the bearing and pump capabilities, a mechanically simple hermetically sealed pump can be constructed in which the rotor, having helical grooves on the outer surface, functions as both a bearing and pump.

To check the feasibility and performance of the combined bearing-pump, a device shown in Figure 1 was built and tested. It consisted of a transparent acrylic plastic housing and a steel bearing-pump rotor that was coupled by permanent magnets to a variable speed electrical drive. Helical-groove patterns were machined into the rotor housing. Spiral-groove patterns chemically etched on both end-faces of the rotor (Figure 1b) served as the thrust bearings. Fluid flow was from the reservoir to the inlet feed holes at the center of the helical pump. From the center, the fluid was pumped toward the ends by the two helical sections of the rotor. From the ends, the flow was discharged back into the reservoir.

Torque measurements revealed that the rotor lifted out of contact to the housing and operated as a journal bearing above some minimum speed, depending upon the fluid being pumped. The relation between pump discharge flow and pressure was investigated and the results indicated that pump effectiveness increased as the speed was increased.

Figure 2 (an example of an application of the combined bearing and pump) is a schematic drawing of the hermetically sealed pump concept in which an electric motor armature contains a combined pump and bearing helical geometry on the outside diameter, and a combined spiral groove pump and thrust bearing on each end face. Fluid flow is into each end.

(continued overleaf)

The spiral grooves pump the fluid radially outward and the helical grooves pump the fluid axially toward the center discharge port.

Notes:

1. The concept depicted in Figure 2 was not tested and is offered only as a possible application of the combined bearing pump.
2. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10320
3. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B69-10320

Patent status:

No patent action is contemplated by NASA.

Source: L. P. Ludwig and T. N. Strom
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(LEW-10837)

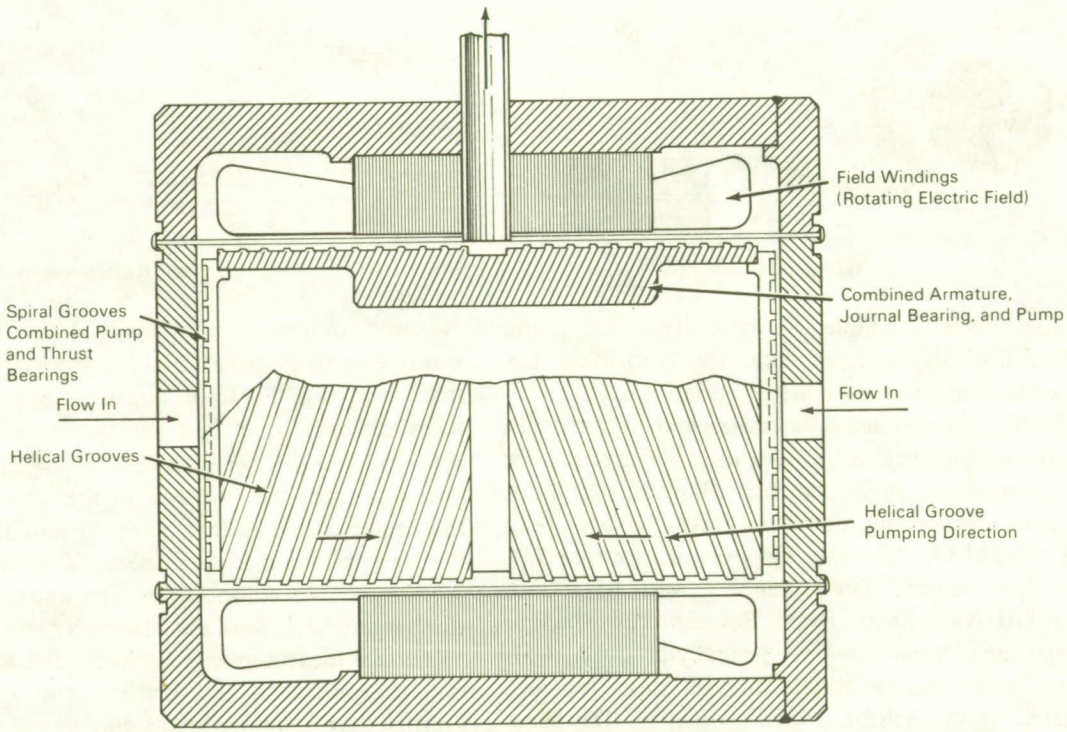

Fig. 2. Hermetically Sealed Pump Concept Using a Single Rotating Element as a Combined Motor Armature, Bearing and Pump